UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,953	07/25/2006	Makoto Iida	128832	3409

25944 7590 03/15/2012

OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1714	

NOTIFICATION DATE	DELIVERY MODE
03/15/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

OfficeAction25944@oliff.com
jarmstrong@oliff.com

Office Action Summary	Application No.	Applicant(s)	
	10/586,953	IIDA ET AL.	
	Examiner	Art Unit	
	MATTHEW SONG	1714	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *7/1/2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *49,50,55-72 and 77* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *49,50,55-72 and 77* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/17/2011; 8/10/2011*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/1/2011 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 49-50 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurada et al (US 2003/0116082) in view of Takano et al (US 5,361,721), Ikeda et al (US 5,762,672) and Yokota et al (US 5,067,989) and further in view of Holder et al (US 6,214,109).

Sakurada et al teaches a method for producing a silicon single crystal according to the Czochralski method comprising melting a raw material in a crucible (Abstract and [0059]); contacting a seed crystal on a melt surface ([0091]-[0097]); growing a silicon single crystal by using an apparatus ([0091]-[0097]). Sakurada et al teaches a defect region in the silicon single crystal contains Nv region outside an OSF ring over an entire region in a direction of a crystal growth axis (Fig 1).

Sakurada et al is silent to the Cu concentration of components made of quartz being 1 ppb or less and components made of quartz other than the crucible.

In a Czochralski crystal growth method, Takano et al teaches a Czochralski apparatus comprising a quartz crucible and a quartz ring shield (Abstract, Fig 1, col 5, ln 10-65 and col 6, ln 25-60), which clearly suggests a part made of quartz other than the crucible. Takano et al also teaches the quartz ring makes it possible to increase the growth rate of the single crystal (col 3, ln 60 to col 4, ln 40). Takano et al also teaches the quartz ring is made of high purity quartz glass and it is needless to say that the purity must be made as high as that of the quartz crucible so as to kept the melt as clean as possible (col 6, ln 50-60).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sakurada et al by including a quartz ring, as taught by Takano et al, to increase the growth rate, thereby increasing productivity.

The combination of Sakurada et al and Takano et al teaches high purity quartz components within the Czochralski apparatus, thus is silent to the concentration of copper being 1 ppb or less.

In a method of making a quartz glass crucible for the Czochralski process, Ikeda et al teaches a quartz glass crucible with a impurity of 0.5 ppb or less of Cu (Abstract and Table 4), overlapping ranges are prima facie obvious. Ikeda et al teaches the high purity crucible allows for single crystal silicon to obtain a plurality of times at a high crystallization ratio and enable high quality silicon single crystal (col 7, ln 45-55).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al and Takano et al by making the high purity quartz have an Cu concentration of 1 ppb or less, as taught by Ikeda et al, to reducing concentration of impurity, thereby forming a high purity silicon single crystal.

As to the temperature range of 1000°C or more is 1 ppb or less and a temperature less than 1000°C is 10 ppb or less, the crucible and quartz ring are present in the Czochralski apparatus during silicon single crystal growth, which requires heating to the melting point of silicon, i.e. approximately 1400°C, thus is present at temperature greater than 1000°C and is also in the apparatus as the apparatus is heated to the melting point of silicon and cooled to room temperature from the melting point of silicon, thus is in a part where the temperature is less than 1000°C.

The combination of Sakurada et al, Takano et al and Ikeda et al is silent to the Cu concentration of the single crystal is less than $1x10^{12}$ atoms/cm^3.

In a method of making silicon single crystal, Yokota et al teaches Cu contained as impurities in a single crystal silicon grown using the Czochralski method is at concentration of less than 0.1 ppta so that oxygen induced stacking faults are reduced to an absolute minimum (Abstract and col 3, ln 1-60). A concentration of less than 0.1 ppta overlaps the claimed range of $1x10^{12}$ atoms/cm^3 because the range of less than 0.1 ppta includes 0. Overlapping ranges are prima facie obvious (MPEP 2144.05).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al and Ikeda et al to have a Cu concentration of the single crystal less than $1x10^{12}$ atoms/cm^3 so that oxygen induced stacking faults are reduced to an absolute minimum, as taught by Yokota et al.

The combination of Sakurada et al, Takano et al, Ikeda et al, and Yokota et al does not teach a quartz window with 10 ppb or less Cu.

In a Czochralski apparatus, Holder et al teaches a cap **31** is made of high purity quartz which will not contaminant the melt **23** in the crucible and the cap has a view port **9** (window) which allows for observation of the crystal growth (col 4, ln 10-67 and Fig 1). Holder et al also teaches the cap is used to isolate a portion of the atmosphere above the crucible from vapors to protect equipment (col 2, ln 40 to col 3, ln 50).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al by including a high purity quartz cap a window for observation, as taught by Holder et al, to isolate a portion of the atmosphere above the crucible from vapors to protect equipment.

As to the purity, the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al and Holder et al, as discussed above, teaches it is obvious to have the quartz parts be as high in purity as the crucible to reduce impurities and a concentration of less than 0.5 ppb is obvious to prevent contamination of the melt, and high purity synthetic quartz is well known in the art.

Referring to claim 50, the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al and Holder et al does not teach any components formed with Cu as a raw material, and clearly suggests using high purity materials which do not include Cu as an impurity.

4. Claims 55-64, 74, and 78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurada et al (US 2003/0116082) in view of Takano et al (US 5,361,721), Ikeda et al (US 5,762,672), Yokota et al (US 5,067,989) and Holder et al (US 6,214,109), as applied to claims 49-50 and 77 above, and further in view of Oda et al (US 2003/0000457).

The combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al and Holder et al teaches all of the limitations of claims 55-58, as discussed previously, except the taking out of furnace components and transferring in an environment of class 1000 or more, and cleaning which maintaining cleanliness at class 1000 or more.

In a pulling room apparatus for Czochralski growth, Oda et al teaches cleaning the furnace body and operations requiring high cleanness are separated from each other (Abstract), and dismantling the furnace to cleaned ([0037]) and Oda et al teaches the degree of clean can be set to 1000, or 100 or 10 ([0040]-[0042]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al and

Holder et al by transferring and cleaning in a high cleanness environment, as taught by Oda et al, to safely perform operations which require cleanness without any problems of contamination.

Referring to claim 59-62, the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al does not teach any cleaning tools which contain Cu as raw material, and it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al to not use cleaning tool which contain Cu as a raw material because the prior art recognizes Cu as an undesirable impurity.

Referring to claim 63-64, the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al a cleanness of 1000 or more.

5. Claims 65-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurada et al (US 2003/0116082) in view of Takano et al (US 5,361,721), Ikeda et al (US 5,762,672) and Yokota et al (US 5,067,989), Holder et al (US 6,214,109) and Oda et al (US 2003/0000457), as applied to claims 55-64 above, and further in view of Holder et al (US 6,344,083).

The combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al teaches all of the limitations of claim 65, as discussed above, except the time and energy parameters.

In a method of Czochralski crystal growth, Holder et al teaches melting an equilibrium phase of raw material for 3.5 hrs and utilization of heaters at appropriate temperature settings and insoluble (inert) gas (cols 1-6, lns 1-69).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al with the teachings of Holder to ensure an appropriate and defect free fabrications of Si crytals.

As to the electrical power, this is a result effective variable readily determined by the operators usage. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sakurada et al, Takano et al, Ikeda et al, Yokota et al, Holder et al and Oda et al by using 80% or more of the power to melt the raw material more quickly, thereby increasing productivity.

Response to Arguments

6. Applicant's arguments with respect to claims 49, 50, 55-72 and 77 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

7. Applicant's argument that the reference would not have provided any motivation to use high purity components for an observation window made of quartz that is not in direct contact with the melt is not persuasive. Newly applied Holder et al (US 6,214,109) teaches using a high purity quartz cap which is not in contact with the melt to prevent contaminating the melt (col 4, ln 30-55); therefore the Examiner maintains that the use of high purity quartz parts in all parts of the Czochralski apparatus would have been obvious to one of ordinary skill in the art to prevent contamination.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 11:00-7:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Primary Examiner
Art Unit 1714

/Matthew J Song/
Primary Examiner, Art Unit 1714